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EXAMINER	
SAXENA, AKASH	
ART UNIT	PAPER NUMBER
2128	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/925,743	HAGIWARA ET AL.	
	Examiner	Art Unit	
	Akash Saxena	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 July 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13,15-30 and 32-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13, 15-30 and 32-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1. Claim(s) 1-13, 15-30 and 32-34 have been presented for examination based on amendment filed on 17th October 2005.

2. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn. Examiner acknowledges the petition, filed on 8th June 2006, now being treated as a "request for reconsideration" and the prosecution on the merits is being reopened.

3. New art rejection ("Yoon" reference) was provided to address the limitation present in claim 7.

4. The arguments submitted by the applicant have been fully considered but are now moot in view of new 35 USC 112 rejections.

5. Current claims 1-13, 15-30 and 32-34 remain rejected.

Response to Applicant's Remarks for 35 U.S.C. § 103

Regarding Claim 1

Applicant has argued that:

> Hong teaches a computer model for control system design of engines having automatic transmissions. However, Hong teaches simulation, only. Hong does not disclose or suggest a shift controller mounted on a vehicle and having a shift control algorithm stored therein, as recited in claim 1. Similarly, Hong fails to disclose or suggest a hydraulic actuator transmitting power generated by the internal combustion engine to drive wheels, as recited in claim 1.

Examiner respectfully disagrees, as Hong teaches shift controller mounted on a vehicle and having a shift control algorithm stored therein (Hong: Fig.2 shift controller as ECU). ECU stores the shift control algorithm. Further, Hong teaches hydraulic actuator transmitting power generated by the internal combustion engine to drive wheels (Hong: Fig.1-2 hydraulic actuator as transmission gear clutch with hydraulic circuit connected to ECU). The arguments being presented are contrary to one of ordinary skill in art of automatic transmission design.

Further applicant has argued that:

> The Applicants submit that neither the third paragraph of page 108 nor the abstract of Hong discloses a ***control system design tool*** connected to the shift controller for inputting the shift control algorithm and for outputting a hydraulic pressure supply command such that the hydraulic pressure supply command is supplied to the hydraulic actuator through the hydraulic circuit based on a shift signal from shift control algorithm, as recited in claim 1.

Hong teaches MATLAB/SIMULINK as the control system design tool connected to the shift controller for inputting the shift control algorithm as (Pg.108-109):

> ***Wagner and Furry [3] developed a real-time hardware-in-the-loop simulation facility for the verification of automotive electronic controller software***. Sayers and Mink [4] described the architecture and use of a simulation graphical user interface using object-oriented graphical database programs for vehicle dynamic models. ***Ciesla and Jennings [5] presented a library of micro-modules to evaluate the dynamic loadings on powertrain components*** and shift quality, and to develop control systems. Weeks and Moskwa [6] presented an engine model for real-time control by using ***SIMULINK block libraries***.

Hong clearly teaches that that hardware in loop simulation (where the simulation units are connected to actual hardware) using the SIMULINK block libraries of electronic controller software (ECU having the shift control algorithm in software).

Further on Pg. 109 Hong teaches

> The contributions of this article are as follows. This report proposes a computer software simulator for the powertrain system. The simulator provides various simulation environments for developing powertrain components and control systems. The program is constructed in such a way that the whole powertrain module is easily attached to a larger simulation module (for example, a vehicle simulator) and its submodules are independently used by themselves. ***Characterizing the attributes of the powertrain components, various modules for the engine, transmission, and driveline are constructed in SIMULINK block library form.***

As modeling the transmission (powertrain) system specifically using the SIMULINK block libraries. It would be obvious to one skilled in the art of designing control system of shift controller for a vehicle that the limitation above is taught by Hong. Examiner finds applicant's arguments unpersuasive.

Applicant has pointed out that Hong does not have Fig.1 elements 20, 23-35. Examiner admits this as typographical error, and the teachings were intended to be presented as Iizuka's teaching. Rejection is updated to reflect that.

Further applicant has stated that Hong does not disclose a relationship between the shift stage and a pressure profile. Examiner does not see the limitation being argued in the claim. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., pressure profile) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Further applicant has presented arguments for the absence of second model in the combined teachings of Hong and Iizuka. Examiner disagrees, as a second simulator section is taught as the learning control section on a CPU (Iizuka '188: Col.6, Lines 13-16; Fig.1, Elements 26-28), which determines the transfer functions (alpha1)(Iizuka '188: Col.6, Lines 30-42) (alpha2) (Iizuka '188: Col.6, Lines 42-29).

Examiner finds applicant's arguments unpersuasive and maintains the rejection for claim 1 and dependent claims 2-6.

Regarding Claim 7 & 12

Applicant has agued that:

> The Applicants respectfully submit that the time difference between the actual shifting period and the target shifting period of Iizuka cannot satisfy both the value to determine deviation of the characteristics from a predetermined standard and the parameter that affects the characteristics recited in claims 7 and 12.

Examiner is unclear as to what limitation is not being met by the arguments provided above. Examiner is asserting that the difference between the actual and target shifting period is the deviation from the predetermined standard (target), which is a parameter in the degradation of the transmission.

Applicant has agued that:

> Moreover, according to the Office Action, Iizuka discloses the claimed parameter extracting means at col. 1, lines 21-36 thereof. However, beginning at col. 1, Line 20, Iizuka discloses a preventing shift shock from increasing due to fluctuation of shifting performance of...due to tolerance in spool valves, springs and so on.. . However, Iizuka neither discloses nor suggests parameter-extracting means for extracting a parameter having influence on the characteristics when durability of the transmission is degraded.
>
> The Office Action further asserts that Yoon teaches "transmission characteristic analyzing means." However, Yoon teaches only a varying friction coefficient, and is not concerned with a durability drop due to aging.

Examiner asserts that the shifting period (and resulting shift shock) and friction co-efficient are the parameter, which are extracted having influence on the characteristics when durability of the transmission is degraded. Further, Applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. Specifically, applicant has <u>not pointed out in disclosure and claimed</u> what parameter is of an influence on the characteristics of transmission when durability of the transmission is degraded.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "Yoon teaching only a varying friction coefficient, and is not concerned with a durability drop due to aging.") are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 SPQ2d 1057 (Fed. Cir. 1993).

Further response to arguments is moot in view of new 35 USC 112 rejections and issues discussed during interview with applicant's representative (on 7th August 2006 – See interview summary attached).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-13, 15-30 and 32-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

<u>Regarding Claim 1, 7, 12, 18, 24 and 29</u>

The Claim 1 preamble can be read multiple ways, which gives presents different interpretations for the claim.

Claim 1-preamble states:

> "A simulator having computer aided design programs for simulating a shift control algorithm stored in a shift controller of an automatic transmission mounted on a vehicle, said vehicle having a hydraulic actuator to transmit power generated by an internal combustion engine to drive wheels based on at least throttle opening and vehicle speed in accordance with the shift control algorithm, comprising:"

For example, <u>first</u> interpretation could be an apparatus claim, however the limitation present in the claim include the ECU and even seem to include the vehicle (more like system claim).

<u>Second</u> interpretation could mean a simulator mounted on the vehicle performing the simulation. But this interpretation seems to be contradictory because if the simulation is executed in the ECU, then examiner fails to see the need for a hydraulic actuator and combustion engine (vehicle).

<u>Third</u> interpretation includes defining the body of the claim as it is unclear what comprises the body – (e.g. are these steps comprised in the shift control algorithm, are these steps comprised in the simulator CAD tool, are these models comprised in

the ECU (shift controller of an automatic transmission) or in the overall vehicle having some kind of onboard simulation capability).

All the independent claims are replete with same or similar preamble language, making the claims 1-13, 15-30 and 32-34 indefinite.

Claim 1 further state:

> "a second simulator section connected to the control system design tool and to the first simulator section for determining transfer functions of a second model describing behavior of the hydraulic actuator such that an output of the <u>second model converges with the estimated effective hydraulic pressure</u>,
> wherein the second simulator section simulates and evaluates the shift control algorithm based on a third model obtained by <u>incorporating</u> the second model with the first model."

It is unclear if the <u>converging</u> second model with estimated effective hydraulic pressure (output of the first model) is the same as forming the third model by <u>incorporating</u> second and first model. A clear step is needed to clarify if a third model is formed or output of the first and second models is converged to get a final output.

<u>Regarding Claim 7</u>

Claim 7 uses means for language, however applicant has not pointed towards support for such language in the specification. Examiner respectfully requests applicant to clearly and precisely point out for support for each means for step to enable clear & concise prosecution.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. **Claim 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over article "Object-Oriented Modeling for Gasoline Engine and Automatic Transmission Systems" by K. Hong et al. (Hong '1998 hereafter) in view of U.S. Patent No. 5,885,188 issued to Naonori Iizuka (Iizuka '188 hereafter).**

Regarding Claim 1

Hong '1998 teaches

> "A simulator having computer-aided design programs for simulating a shift control algorithm stored in a shift controller of an automatic transmission mounted on a vehicle, said vehicle having a hydraulic actuator to transmit power generated by an internal combustion engine to drive wheels based on at least throttle opening and vehicle speed in accordance with the shift control algorithm, comprising; ... "

as a MATLAB/SIMULINK simulator (Hong '1998: Pg.109), simulating a shift control algorithm (Hong '1998: Pg.109, Abstract) for shift controller of an automatic transmission for a vehicle with internal combustion engine (Hong '1998: Abstract) based on the at least throttle opening and vehicle speed (Hong '1998: Page 114).

Further, Hong '1998 teaches

> "a control system design tool connected to the shift controller for inputting the shift control algorithm and for outputting a hydraulic pressure supply command such that the hydraulic pressure supply command is supplied to the hydraulic actuator through the hydraulic circuit based on a shift signal from shift control algorithm;..."

as MATLAB/SIMULINK Tool (Hong '1998: Pg.109, Abstract) which can be connected to the shift controller (Hong '1998: Page 108, 3rd Paragraph) to input the algorithm which outputs the hydraulic pressure supply command based on the algorithm (Hong '1998: Pg.109, Abstract).

The hydraulic circuits & actuator although disclosed (Hong: Fig.2 "Hydraulic circuit" & "TRANSMISSION") are not explicitly taught by Hong as disclosed (Hong: Fig.1 Element 20, 23-25).

Further, Hong '1998 teaches

> "a first simulator section connected to the control system design tool for inputting the hydraulic pressure supply command for estimating an effective hydraulic pressure generated in the hydraulic actuator in response to the hydraulic pressure supply command based on a first model; ..."

As a first simulator to input the hydraulic pressure supply command (Hong '1998: Pg.113, "AT Controller Module") which estimates an effective hydraulic pressure based on the first model (Hong '1998: Pg.109 3rd Paragraph and AT module).

Hong '1998 does not teach a second model describing the behavior of hydraulic actuator such that first and second model converge.

The hydraulic circuits & actuator are explicitly taught by Iizuka '188 as disclosed (Iizuka '188: Fig.1 Element 20, 23-25).

Iizuka '188 teaches

> "and a second simulator section which is connected to the control system design tool and the first simulator section for determining transfer functions of a second model describing behavior of the hydraulic actuator such that an output of the second model converges with the estimated effective hydraulic pressure; wherein the second simulator section simulates and evaluates the shift control algorithm based on a third model obtained by incorporating the second model with the first model."

as a second simulator section as a learning control section on a CPU (Iizuka '188: Col.6, Lines 13-16; Fig.1, Elements 26-28) which determines the transfer functions (alpha1)(Iizuka '188: Col.6, Lines 30-42) (alpha2) (Iizuka '188: Col.6, Lines 42-29). Iizuka '188 teaches convergence of the estimated hydraulic pressure with the one predicted with the model (Iizuka '188: Col.1, Lines 28-37). Further, Iizuka '188 teaches a method for running the converged automatic transmission system (Iizuka '188: Fig.1, Elements 26 & 13). The third model is obvious as combined or converged first and second models generate a converged hydraulic pressure

(functionally the output of the third model) for simulating the converged automatic transmission system (Iizuka '188: Fig.1, Elements 26 & 13).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Iizuka '188 with Hong '1998 to create a converged model simulator for an automatic transmission controller describing the behavior of hydraulic actuator. The motivation would have been that Iizuka '188 solving the problem of correctly predicting the hydraulic pressure & storing it in the map or the like (Iizuka '188: Col.1, Lines 28-37). Further motivation comes from Hong '1998 as he considers modeling the clutch pressure to be complex for the complete system model (first simulation) and estimates the clutch pressure with equations 3(a), (b), (c) (Hong '1998: Pg.114), but goes on the teach that entire model or parts of it can be modified to be included in the entire model leading to reduced programming effort (Hong '1998: Pg.109, Paragraph 2). Thus both references provide motivation towards each other to improve the model of the automatic transmission system for simulation purposes.

<u>Regarding Claim 2</u>

Teachings of Hong '1998 are disclosed in the claim 1 rejection above. Hong '1998 does not teach a host computer for storing data for determining the transfer function by retrieving the data with a predetermined parameter.

Iizuka '188 teaches a host computer (Iizuka '188:Col.6, Lines 12-15) for storing the mechanism for the transfer function (shifting period storage portion) (Iizuka '188:

Col.6, Lines 30-42) based on the predetermined parameter (target shifting period based on the predetermined driving conditions) (Iizuka '188: Col.6, Lines 35-37).

Regarding Claim 3

Teachings of Hong '1998 are disclosed in the claim 1 rejection above. Hong '1998 does not teach transfer function as being a predetermined time period after which the output of second model beings to increase.

Iizuka '188 teaches a transfer function (shifting period storage portion) (Iizuka '188: Col.6, Lines 30-42) drives the output of based on aforementioned time (Iizuka '188: Col.6, Lines 42-49).

Regarding Claim 4

Teachings of Hong '1998 are disclosed in the claim 1 rejection above. Iizuka '188 teaches that the output is generated whenever the input value is exceeding the predetermined period of time (Iizuka '188: Col.6, Lines 35-49).

Regarding Claim 5

Teachings of Hong '1998 are disclosed in the claim 1 rejection above. Iizuka '188 teaches a second transfer function to converge with estimated hydraulic pressure (Iizuka '188: Col.6, Lines 42-49).

Regarding Claim 6

Teachings of Hong '1998 are disclosed in the claim 2 rejections above. Iizuka '188 teaches the predetermined parameter is hydraulic supply command and shift interval (Iizuka '188: Fig.1, Elements 20,25,26; Col.5, Lines 60-67; Col.6, Lines 30-49).

8. Claim 7-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over article "Object-Oriented Modeling for Gasoline Engine and Automatic Transmission Systems" by K. Hong et al. (Hong hereafter) in view of U.S. Patent No. 5,885,188 issued to Naonori Iizuka (Iizuka hereafter), further in view of "Design of Computer Experiments for Open-Loop Control and Robustness Analysis of Clutch to Clutch Shifts in Automatic Transmission" by Albert Yoon et al (Yoon hereafter).

Regarding Claim 7

Claim 7 presents similar limitations of problem description as claim 1 and is rejected for the same reasons in most part as claim 1. More specifically, besides the teachings presented by Hong and Iizuka above claims is further rejected as follows.

Iizuka teaches "transmission characteristic analyzing means (Specification: Fig.24) for analyzing characteristics of the transmission when shift is conducted in accordance with the shift control algorithm through a value to determine deviation of the characteristics from a predetermined standard" as deviation analysis between the actual shifting period and target shifting period and "parameter extraction means" to measure/derive the shit period difference (Iizuka: Col.6 Lines 30-49; Col.5, Lines 46-59).

Further, Iizuka '188 teaches that the shifting period have impact on the shift shock and hence durability of the transmission (Iizuka: Col.1, Lines 21-36). Hence parameter extraction means to get the correct shifting period can be extracted from the system (model) based on the learning system (Iizuka: Fig.1, Elements 26-28).

Further, Iizuka '188 teaches that the learning system can correct the shifting period ("correcting means") if there are any anomalies (Iizuka: Col.2, Lines 50-57).

As seen above Iizuka is concerned with the avoiding undesirable shift condition by coming up with the best possible shifting period, however Iizuka does not appear to teach the forecasting the undesirable shift phenomenon using simulation. Hong also does not explicitly teach such a phenomenon.

The undesirable shift phenomenon means as understood, is the ineffective clutch pressures due to various shifting period on each incoming and off going clutches, leading to racing or spike in the engine speed (Specification: Fig: 31).

Yoon is a simulation system concerned with avoiding this undesirable shift condition based on a model based on the changing parameters like clutch plate friction co-efficient and clutch cavity fill delay and finding bounds of these parameters (Yoon: Pg.3360 Section 2.2 ¶1 –Problem description of undesirable shifting phenomenon; Section 2.2 ¶2 – Modeling, parameter bound identification).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Iizuka '188 with Hong '1998 to create a converged model simulator for an automatic transmission controller describing the behavior of hydraulic actuator. The motivation would have been that Iizuka '188 solving the problem of correctly predicting the hydraulic pressure & storing it in the map or the like (Iizuka '188: Col.1, Lines 28-37). Further motivation comes from Hong '1998 as he considers modeling the clutch pressure to be complex for the complete system model (first simulation) and estimates the clutch pressure

with equations 3(a), (b), (c) (Hong '1998: Pg.114), but goes on the teach that entire model or parts of it can be modified to be included in the entire model leading to reduced programming effort (Hong '1998: Pg.109, Paragraph 2). Thus both references provide motivation towards each other to improve the model of the automatic transmission system for simulation purposes. Motivation to combine Iizuka to Hong is detailed above as **"Rational for combining Hong '1998 and Iizuka '188".**

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Yoon with Hong-Iizuka to create a converged hardware in loop model simulator (HILS) for an automatic transmission controller describing the behavior of hydraulic actuator. Hong considers the exact mechanics of clutch pressure modeling to be very complex and models them as simple equation (Hong '1998: indicated by the Eqs.3 (a-c)) and Iizuka uses a model and map based learning solution to obtain the optimum solution for shifting period (critical timing parameter determining the quality of shift). Neither of them addresses the core reason for difference between the actual shifting period and corrected shifting period. Yoon corrects this deficiency by modeling the clutch-to-clutch handoff thereby establishing bounds for actual parameter (clutch plate friction co-efficient and clutch cavity fill delay among other parameters) (Yoon: Section 4.1, 4.3; Section 5) that cause the shifting period to vary. It would be highly beneficial to run such a simulation with these parameters included in the algorithm (or in learning

portion of Iizuka's model) for accurate prediction of shifting period in the automatic transmission.

Regarding Claim 8

Iizuka '188 teaches repeating as the process for correct shifting and hydraulic pressure values (Iizuka '188: Col.8 Lines 17-29; 62-67; Col.9 Lines 1-8).

Regarding Claim 9

The behavior of the model, i.e. how the output should be optimized through the model, is stored (Iizuka '188: Col.6, Lines 30-45).

Regarding Claim 10

Iizuka '188 teaches at least part of the shift control algorithm is based on the forecast (Iizuka '188 Col.6, Lines) in form of a map.

Regarding Claim 11

Iizuka '188 teaches that automatic transmission fluid temperature is at least one of the parameters (Iizuka '188: Col.8, Lines 3-16).

Regarding Claim 12

Hong '1998 teaches

> "A simulator having computer-aided design programs for simulating a shift control algorithm stored in a shift controller of an automatic transmission mounted on a vehicle and having a hydraulic actuator to transmit power generated by an internal combustion engine to drive wheels based on at least throttle opening and vehicle speed in accordance with the shift control algorithm, comprising; ... "

as a MATLAB/SIMULINK simulator (Hong '1998: Pg.109), simulating a shift control algorithm (Hong '1998: Pg.109, Abstract) for shift controller of an automatic transmission for a vehicle with internal combustion engine (Hong '1998: Abstract) based on the at least throttle opening and vehicle speed (Hong '1998: Page 114).

Further, Hong '1998 teaches

> "a control system design tool which is connected to the shift controller to inputs the shift control algorithm and which outputs a hydraulic pressure supply command based on the inputted shift control algorithm;..."

as MATLAB/SIMULINK Tool (Hong '1998: Pg.109, Abstract) which can be connected to the shift controller (Hong '1998: Page 108, 3rd Paragraph) to input the algorithm which outputs the hydraulic pressure supply command based on the algorithm (Hong '1998: Pg.109, Abstract).

Further, Hong clearly teaching "a first simulator section" as Automatic Transmission control (AT controller module) system, "connected to the control system design tool" as MATLAB /SIMULINK Software tool, "for inputting the hydraulic pressure supply command and for estimating an effective hydraulic pressure in the hydraulic actuator" as inputting hydraulic pressure supply command the command based on the shift schedule (Hong '1998: Pg.113 CONTROLLER MODULE AT Controller Module), "for estimating an effective hydraulic pressure in the hydraulic actuator in response to the hydraulic pressure supply command based on a first model" as estimating the hydraulic pressure in various gear plates in various profiles based on the shift schedule (Hong '1998: indicated by the Eqs.3 (a-c)).

Hong '1998 does not teach a second model describing the behavior of hydraulic actuator such that first and second model converge.

Iizuka teaches "a second simulator section connected to the control system design tool" a second simulator section as a learning control section on a CPU (Iizuka '188: Col.6, Lines 13-16; Fig.1, Elements 26-28), and "to the first simulator section for determining transfer functions of a second model describing behavior of the hydraulic actuator", as determining

the transfer functions (alpha1)(Iizuka '188: Col.6, Lines 30-42) (alpha2) (Iizuka '188: Col.6, Lines 42-29) between the first model (by Hong) and the second model (by Iizuka). Iizuka '188 teaches "such that an output of the second model converges with the estimated effective hydraulic pressure" as convergence of the estimated hydraulic pressure with the one predicted by the model (Iizuka '188: Col.1, Lines 28-37). The "convergence" is understood to be the convergence between the first model and second model hydraulic pressure using the transfer function as defined and rejected above.

The limitation "wherein the second simulator section simulates and evaluates the shift control algorithm based on a third model obtained by incorporating the second model with the first model.", is taught by Iizuka '188 as method for running the converged automatic transmission system (Iizuka '188: Fig.1, Elements 26 & 13). The third model is obvious as combined or converged first and second models generate a converged hydraulic pressure (functionally the output of the third model).

Iizuka teaches "transmission characteristic analyzing means (Specification: Fig.24) for analyzing characteristics of the transmission when shift is conducted in accordance with the shift control algorithm through a value to determine deviation of the characteristics from a predetermined standard" as deviation analysis between the actual shifting period and target shifting period and "parameter extraction means" to measure/derive the shit period difference (Iizuka: Col.6 Lines 30-49; Col.5, Lines 46-59).

Further, Iizuka '188 teaches that the shifting period have impact on the shift shock and hence durability of the transmission (Iizuka: Col.1, Lines 21-36). Hence parameter extraction means to get the correct shifting period can be extracted from

the system (model) based on the learning system (Iizuka: Fig.1, Elements 26-28). Further, Iizuka '188 teaches that the "learning system can correct the shifting period" ("correcting means") if there are any anomalies (Iizuka: Col.2, Lines 50-57).

As seen above Iizuka is concerned with the avoiding undesirable shift condition by coming up with the best possible shifting period, however Iizuka does not appear to teach the forecasting the undesirable shift phenomenon using simulation. Hong also does not explicitly teach such a phenomenon.

The "undesirable shift phenomenon means" as understood, is the ineffective clutch pressures due to various shifting period on each incoming and off going clutches, leading to racing or spike in the engine speed (Specification: Fig: 31).

Yoon is a simulation system concerned with avoiding this undesirable shift condition based on a model based on the changing parameters like clutch plate friction co-efficient and clutch cavity fill delay and finding bounds of these parameters (Yoon: Pg.3360 Section 2.2 ¶1 –Problem description of undesirable shifting phenomenon; Section 2.2 ¶2 – Modeling, parameter bound identification). Yoon also teaches the "parameter extraction means" in Fig.3 (Yoon: Pg.3362).

Motivation to combine Iizuka with Hong is provided in the previous office action claim 1 and further detailed above as **"Rational for combining Hong '1998 and Iizuka '188".**

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to combine the teachings of Yoon with Hong-Iizuka to create a converged hardware in loop model simulator (HILS) for an automatic

transmission controller describing the behavior of hydraulic actuator. Hong considers the exact mechanics of clutch pressure modeling to be very complex and models them as simple equation (Hong '1998: indicated by the Eqs.3 (a-c)) and Iizuka uses a model and map based learning solution to obtain the optimum solution for shifting period (critical timing parameter determining the quality of shift). Neither of them addresses the core reason for difference between the actual shifting period and corrected shifting period. Yoon corrects this deficiency by modeling the clutch-to-clutch handoff thereby establishing bounds for actual parameter (clutch plate friction co-efficient and clutch cavity fill delay among other parameters) (Yoon: Section 4.1, 4.3; Section 5) that cause the shifting period to vary. It would be highly beneficial to run such a simulation with these parameters included in the algorithm (or in learning portion of Iizuka's model) for accurate prediction of shifting period in the automatic transmission.

Regarding Claim 13

Claim 13 discloses the same limitations as claim 8 and is rejected for the same reasons as claim 8.

Regarding Claim 15

Claim 15 discloses the same limitations as claim 9 and is rejected for the same reasons as claim 9.

Regarding Claim 16

Claim 16 discloses the same limitations as claim 10 and is rejected for the same reasons as claim 10.

Regarding Claim 17

Claim 17 discloses the same limitations as claim 11 and is rejected for the same reasons as claim 11.

Regarding Claim 18

Claim 18 discloses the same limitations as claim 1 and is rejected for the same reasons as claim 1. It was pointed out that steps (c) and (d) were not clearly taught by Hong and Iizuka. Iizuka teaches step (c) transfer function as "hydraulic pressure correction value setting portion 31" to converge with estimated hydraulic pressure (Iizuka '188: Col.6, Lines 42-49; Col.4 Lines 16-22). Iizuka teaches step (d) as method for simulating shift control algorithm for converged automatic transmission system (Iizuka '188: Fig.1, Elements 26 & 13). The third model is obvious as combined or converged first and second models generate a converged hydraulic pressure (functionally the output of the third model).

Regarding Claim 19

Claim 19 discloses the same limitations as claim 2 and is rejected for the same reasons as claim 2.

Regarding Claim 20

Claim 20 discloses the same limitations as claim 3 and is rejected for the same reasons as claim 3.

Regarding Claim 21

Claim 21 discloses the same limitations as claim 4 and is rejected for the same reasons as claim 4.

Regarding Claim 22

Claim 22 discloses the same limitations as claim 5 and is rejected for the same reasons as claim 5.

Regarding Claim 23

Claim 23 discloses the same limitations as claim 6 and is rejected for the same reasons as claim 6.

Regarding Claim 24

Claim 24 discloses the same limitations without "means for language", as in claim 7 and is rejected for the same reasons as claim 7 above.

Regarding Claim 25

Claim 25 discloses the same limitations as claim 8 and is rejected for the same reasons as claim 8.

Regarding Claim 26

Claim 26 discloses the same limitations as claim 9 and is rejected for the same reasons as claim 9.

Regarding Claim 27

Claim 27 discloses the same limitations as claim 10 and is rejected for the same reasons as claim 10.

Regarding Claim 28

Claim 28 discloses the same limitations as claim 11 and is rejected for the same reasons as claim 11.

Regarding Claim 29

Hong teaches

> "A method for simulating a shift control algorithm stored in a shift controller of an automatic transmission mounted on a vehicle and said vehicle having a hydraulic actuator to transmit power generated by an internal combustion engine to drive wheels based on at least throttle opening and vehicle speed in accordance with the shift control algorithm, said method comprising steps of; ... "

as a MATLAB/SIMULINK simulator (Hong '1998: Pg.109), simulating a shift control algorithm (Hong '1998: Pg.109, Abstract) for shift controller of an automatic transmission for a vehicle with internal combustion engine (Hong '1998: Abstract) based on the at least throttle opening and vehicle speed (Hong '1998: Page 114).

Hong & Iizuka teach

> (a) inputting the shift control algorithm to output a hydraulic pressure supply command to be supplied to the hydraulic actuator through a hydraulic circuit based on a shift signal in the inputted shift control algorithm;

as inputting hydraulic pressure supply command the command based on the shift schedule (Hong '1998: Pg.113 CONTROLLER MODULE AT Controller Module). Iizuka also teaches inputting the hydraulic pressure supply command the command based on the shift schedule (Iizuka: Fig.1 Element 20 & 24).

Hong teaches

> (b) inputting the hydraulic pressure supply command and estimating an effective hydraulic pressure generated in the hydraulic actuator in response to the hydraulic pressure supply command based on a first model describing entire system including the transmission, and

as estimating the hydraulic pressure in various gear plates in various profiles based on the shift schedule (Hong '1998: indicated by the Eqs.3 (a-c)).

Hong does not teach a limitations pertaining to the second model.

Iizuka teaches

> (c) determining transfer functions of a second model describing behavior of the hydraulic actuator such that an output of the second model converges with the estimated effective hydraulic pressure, and simulating and evaluating the shift control algorithm based on a third model obtained by incorporating the second model with the hydraulic circuit of the first model,

as determining the transfer functions (alpha1)(Iizuka '188: Col.6, Lines 30-42) (alpha2) (Iizuka '188: Col.6, Lines 42-29) between the first model (by Hong) and the second model (by Iizuka). Iizuka '188 teaches "output of the second model converges with the estimated effective hydraulic pressure" as convergence of the estimated hydraulic pressure with the one predicted by the model (Iizuka '188: Col.1, Lines 28-37). The "convergence" is understood to be the convergence between the first model and second model hydraulic pressure using the transfer function. The limitation, "simulating and evaluating the shift control algorithm based on a third model obtained by incorporating the second model with the hydraulic circuit of the first model," is taught by Iizuka '188 as method for running the converged automatic transmission system (Iizuka '188: Fig.1, Elements 26 & 13). The third model is obvious as combined or converged first and second models generate a converged hydraulic pressure (functionally the output of the third model).

Iizuka & Yoon teach

> (d) analyzing accordance with the shift control algorithm through a value to determine deviation of the characteristics from a predetermined standard; characteristics of the transmission when shift is conducted in
> (e) extracting a parameter having influence on the characteristics when durability of the transmission is degraded.

as deviation analysis between the actual shifting period and target shifting period and "parameter extraction" to measure/derive the shit period difference (Iizuka: Col.6

Lines 30-49; Col.5, Lines 46-59). Yoon also teaches the "parameter extraction" in Fig.3 (Yoon: Pg.3362; 3363: section 5).

Iizuka teaches

> (f) conducting simulation based on the third model, while changing the parameter and forecasting occurrence of undesirable phenomenon using the value based on behavior change of the third model; and

as performing the simulation based on the third converged model. Iizuka does not explicitly teach changing the parameters and forecasting "undesirable shift phenomenon" using the behavior change in the third model.

Yoon is a simulation system concerned with avoiding this undesirable shift condition based on a model based on the changing parameters like clutch plate friction co-efficient and clutch cavity fill delay and finding bounds of these parameters (Yoon: Pg.3360 Section 2.2 ¶1 –Problem description of undesirable shifting phenomenon; Section 2.2 ¶2 – Modeling, parameter bound identification).

> (g) correcting the shift control algorithm based on a result of forecasting.

As for step (g), Iizuka teaches correcting algorithm with learning process for correct shifting period, although this is not based on the forecasting performed by Yoon. It would be obvious to one of ordinary skill in the art run such a simulation with these parameters included in the algorithm (or in learning portion of Iizuka's model) for accurate prediction of shifting period in the automatic transmission. Yoon supplements the generalization about the shifting period by a specific model and parameter calculation though simulation (Yoon: Section: 2.3, 4 & 5).

Motivation to combine Hong, Iizuka and Yoon is provided in the claim 7 above.

Regarding Claim 30

Claim 30 discloses the same limitations as claim 8 and is rejected for the same reasons as claim 8.

Regarding Claim 32

Claim 32 discloses the same limitations as claim 9 and is rejected for the same reasons as claim 9.

Regarding Claim 33

Claim 33 discloses the same limitations as claim 10 and is rejected for the same reasons as claim 10.

Regarding Claim 34

Claim 34 discloses the same limitations as claim 11 and is rejected for the same reasons as claim 11.

Conclusion

9. All claims are rejected.
10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
11. **Examiner's Note:** Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

    In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

Communication

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Akash Saxena whose telephone number is (571) 272-8351. The examiner can normally be reached on 9:30 - 6:00 PM M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini S. Shah can be reached on (571)272-2279. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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